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HAIR CONDITIONING COMPOSITIONSTechnical Field

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The present invention is concerned with compositions for conditioning the hair which are typically applied to wet hair which has been shampooed and rinsed with water. The compositions are massaged into the hair followed by further
10 rinsing with water before the hair is dried. Such compositions are known as rinse-off hair conditioners. In particular, the invention is concerned with improvements in the appearance, particularly the opacity of such compositions.

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Background and Prior art.

Rinse-off hair conditioners typically comprise as major components a cationic surfactant in combination with a fatty
20 material, such as a fatty alcohol, in the form of an aqueous dispersion. The surfactant and alcohol are typically present in the composition at room temperature in the form of particles of lamellar liquid crystal (usually a so-called L beta lamellar liquid crystal) suspended in an aqueous
25 solution.

Although the compositions thus formed do not transmit light well, they are not totally opaque. They would be better described as translucent, semi-opaque or opalescent. A
30 corollary of this is that the compositions do not reflect or scatter light particularly well.

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It has been found that many users of these products prefer the products to be opaque and to scatter light well. The resultant milky or creamy appearance conveys to the user that the composition has greater levels of active

5 ingredients and hence will be more effective. Thus it is desirable to form hair conditioner compositions which are more opaque and which have a higher reflectance than prior art compositions.

10 One way to achieve this aim might be to disperse particles of a relatively high refractive index material throughout the composition. Such opacifiers are known to be used in hair treatment compositions (see for example the article by Norbert Boyxen in Olaj, Szappan, Kozmetika 50 (3) 2001).

15 However there is a problem when such opacifiers are present in hair conditioner compositions. The opacifiers are non-functional ingredients, and may have poor biodegradability, particularly when high molecular weight polymer particles are used. The opacifiers may also deposit onto the hair and
20 give the hair a dull, heavy or greasy feeling for some users.

Hence there is a need for an alternative technical route for making hair conditioning compositions appear opaque and
25 milky or creamy.

Surprisingly, it has now been found that a particular combination of cationic surfactants and alkali metal halide salts can confer improved opacity and reflectance on hair
30 conditioning compositions without the need for additional opacifiers.

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Summary of the invention

In one aspect, the invention provides a hair-conditioning composition comprising;

- 5 a) 60% by weight or more of water,
 b) from 0.1 to 10% by weight of alkyl trimethylammonium salt wherein the alkyl group is selected from C₁₆ to C₂₂ saturated alkyl chains and mixtures thereof,
 c) from 0.02 to 5% by weight of dialkylethyl dimethylammonium salt wherein the alkyl chains are
10 selected from C₁₆ to C₂₂ saturated or unsaturated alkyl chains and mixtures thereof,
 d) from 0.5 to 10% by weight of a fatty material, comprising from 12 to 22 carbon atoms, selected from
15 the group consisting of fatty alcohols, fatty acids, alkoxylated fatty alcohols and mixtures thereof, and
 e) from 0.05 to 1% alkali metal halide,
wherein the weight ratio of the alkyl trimethylammonium salt to the dialkylethyl dimethylammonium salt is from 15:1 to 2:1.

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In another aspect, the invention provides a method of preparing an opacified hair conditioning composition by using a composition as described above.

- 25 A further aspect of the invention involves a method of treating the hair comprising the steps of;
- i) applying to the hair a composition as described above,
 ii) rinsing the hair with water and
30 iii) drying the hair.

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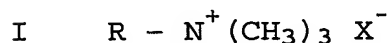
Detailed Description of the Invention.

Compositions according to the invention are aqueous compositions intended to be applied to the hair after
5 shampooing and rinsing. They are massaged into wet hair and scalp, preferably followed by further rinsing with water prior to drying the hair. By aqueous composition, it is meant that the compositions of the invention comprise 60% by weight or more of water, preferably 70% or more, more
10 preferably 80% or more.

Cationic Surfactants

Compositions according to the invention comprise both an
15 alkyl trimethylammonium salt and a dialkylethyl dimethylammonium salt. These materials are both cationic surfactants.

The alkyl trimethylammonium salt is according to formula I
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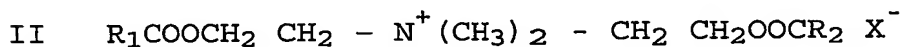


where R is a saturated alkyl chain with from 16 to 22 carbon atoms (i.e. C₁₆ to C₂₂). A mixture of such chains may be
25 present in the alkyl trimethylammonium salt in compositions of the invention. X is preferably a halide or a methosulphate anion or mixtures thereof. Chloride is particularly preferred.

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Particularly suitable alkyl trimethylammonium salts are cetyl trimethylammonium chloride (C₁₆) and behenyl trimethylammonium chloride (C₂₂).

- 5 The level of alkyl trimethylammonium salt in compositions of the invention should be from 0.1 to 10% by weight of the composition, preferably from 0.5 to 7%, more preferably from 1 to 5%.
- 10 The dialkylethyl dimethylammonium salt needed for compositions of the invention is according to formula II:



- 15 Wherein R₁ and R₂ are independently selected from C₁₅ to C₂₁ saturated or unsaturated alkyl chains. X is preferably a halide, a methosulphate anion or mixtures thereof. Chloride is particularly preferred.
- 20 In other words, the cation of the salt has the technical name N,N-dimethyl-2-[(1-oxoalkyl)oxy]-N-[2-[(2-oxoalkyl)oxy]ethyl] where the alkyl is from C₁₆ to C₂₂. These are referred to in the CTFA (8th Edition 2000) as dialkylethyl dimethylammonium salts

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It is preferred if both R₁ and R₂ are the same alkyl group. A particularly preferred salt is dipalmitoylethyl dimethylammonium chloride, commercially available as Armocare VGH-70 (trade name) from Akzo GmbH.

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The compositions according to the invention comprise from 0.02 to 5% by weight of the dialkylethyl dimethylammonium salt, preferably from 0.1 to 3%, more preferably from 0.3 to 1.5%.

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However, in addition to the constraints on levels of cationic surfactants in the compositions, the weight ratio of the alkyl trimethylammonium salt to the dialkylethyl dimethylammonium salt must be from 15:1 to 2:1 to obtain
10 compositions according to the invention. Preferably, the ratio is from 10:1 to 3:1, more preferably from 8:1 to 4:1.

Fatty Material

15 Conditioner compositions of the invention comprise at least one fatty material. The combined use of fatty materials and cationic surfactants in the conditioning compositions is believed to lead to the formation of a structured lamellar or liquid crystal phase, in which the cationic surfactant is
20 dispersed.

By "fatty material" is meant a fatty alcohol, an alkoxyated fatty alcohol, a fatty acid or a mixture thereof.

25 Preferably, the alkyl chain of the fatty material is fully saturated.

Suitable fatty materials comprise from 12 to 22 carbon atoms, preferably from 16 to 18 carbon atoms. Examples of suitable
30 fatty alcohols include cetyl alcohol, stearyl alcohol and mixtures thereof. The use of these materials is also

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advantageous in that they contribute to the overall conditioning properties of compositions of the invention.

Alkoxylated, (e.g. ethoxylated or propoxylated) fatty
5 alcohols having from about 12 to about 22 carbon atoms in the alkyl chain can be used in place of, or in addition to, the fatty alcohols themselves. Suitable examples include ethylene glycol cetyl ether, polyoxyethylene (2) stearyl ether, polyoxyethylene (4) cetyl ether, and mixtures
10 thereof.

The level of fatty material in conditioners of the invention is suitably from 0.5 to 10, preferably from 1 to 6 percent by weight of the total composition. The weight ratio of
15 cationic surfactant to fatty alcohol is suitably from 10:1 to 1:10, preferably from 4:1 to 1:8, optimally from 1:1 to 1:7.

Alkali Metal Salt

20 An essential ingredient of the compositions according to the invention is an alkali metal halide. Mixtures of alkali metal halides may be used.

The alkali metal halide should be present as from 0.05% to
25 1% by weight of the composition. Too low a level leads to the improved reflectance of the compositions not being given, whereas too high a level can lead to separation of the compositions into separate aqueous and liquid crystalline phases, rather than remaining as a stable
30 dispersion.

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Preferably, the alkali metal halide is present as from 0.07 to 0.7% by weight of the composition, more preferably from 0.08 to 0.4%.

- 5 Preferred alkali metals are sodium or potassium and preferred halides are chlorides and bromides. Particularly preferred is potassium chloride.

Process

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A typical process for forming a hair conditioning composition comprising cationic surfactant and fatty material involves separately heating an aqueous dispersion or solution of the cationic surfactant, and the fatty material to a temperature
15 above the melting point of the fatty material (typically 80 °C). The two components are then mixed together such that droplets of fatty material are dispersed as an emulsion in the surfactant solution. Upon cooling the emulsion, the surfactant and fatty material self-assemble into a lamellar
20 liquid crystalline phase (L-beta phase) at some temperature lower than the melting point of the fatty acid but higher than 20°C.

Such a process is suitable for preparing compositions
25 according to the invention. Preferably the alkyl trimethylammonium salt and the dialkoylethyl dimethylammonium salt are mixed in the hot aqueous dispersion prior to addition of the fatty material.

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The alkali metal halide can be added at any stage of the process, but it is preferred if it is added after cooling the composition to less than 30°C.

5 Conditioning Oil

An preferred component of compositions according to the invention is a hydrophobic conditioning oil. In order for such an oil to exist in the preferred form as discrete
10 droplets in the compositions according to the invention, it must be water-insoluble. By water-insoluble is meant that the solubility in water at 25°C is 0.01% by weight or less.

It is preferred if the conditioning oil is non-volatile, by
15 which it is meant that the vapour pressure of the oil at 25°C is less than 10 Pa.

As used herein, the term "conditioning oil" includes any material, which is used to give a particular conditioning
20 benefit to hair. For example, suitable materials are those which deliver one or more benefits relating to shine, softness, combability, wet-handling, anti-static properties, protection against damage, body, volume, stylability and manageability.

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Suitable hydrophobic conditioning oils are selected from hydrocarbon oils, fatty esters, silicone oils and mixtures thereof.

30 Hydrocarbon oils include cyclic hydrocarbons, straight chain aliphatic hydrocarbons (saturated or unsaturated), and

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branched chain aliphatic hydrocarbons (saturated or unsaturated). Straight chain hydrocarbon oils will preferably contain from about 12 to about 30 carbon atoms. Branched chain hydrocarbon oils can and typically may
5 contain higher numbers of carbon atoms. Also suitable are polymeric hydrocarbons of alkenyl monomers, such as C₂-C₆ alkenyl monomers. These polymers can be straight or branched chain polymers. The straight chain polymers will typically be relatively short in length, having a total
10 number of carbon atoms as described above for straight chain hydrocarbons in general. The branched chain polymers can have substantially higher chain length. The number average molecular weight of such materials can vary widely, but will typically be up to about 2000, preferably from about 200 to
15 about 1000, more preferably from about 300 to about 600.

Specific examples of suitable hydrocarbon oils include paraffin oil, mineral oil, saturated and unsaturated dodecane, saturated and unsaturated tridecane, saturated and
20 unsaturated tetradecane, saturated and unsaturated pentadecane, saturated and unsaturated hexadecane, and mixtures thereof. Branched-chain isomers of these compounds, as well as of higher chain length hydrocarbons, can also be used. Exemplary branched-chain isomers are
25 highly branched saturated or unsaturated alkanes, such as the permethyl-substituted isomers, e.g., the permethyl-substituted isomers of hexadecane and eicosane, such as 2, 2, 4, 4, 6, 6, 8, 8-dimethyl-10-methylundecane and 2, 2, 4, 4, 6, 6-dimethyl-8-methylnonane, sold by Permethyl
30 Corporation. A further example of a hydrocarbon polymer is polybutene, such as the copolymer of isobutylene and butene.

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A commercially available material of this type is L-14 polybutene from Amoco Chemical Co. (Chicago, Ill., U.S.A.).

Particularly preferred hydrocarbon oils are the various
5 grades of mineral oils. Mineral oils are clear oily liquids obtained from petroleum oil, from which waxes have been removed, and the more volatile fractions removed by distillation. The fraction distilling between 250°C to 300°C is termed mineral oil, and it consists of a mixture of
10 hydrocarbons ranging from C₁₆H₃₄ to C₂₁H₄₄. Suitable commercially available materials of this type include Sirius M85 and Sirius M125, all available from Silkolene.

Suitable fatty esters are characterised by having at least
15 10 carbon atoms, and include esters with hydrocarbyl chains derived from fatty acids or alcohols, e.g., monocarboxylic acid esters, polyhydric alcohol esters, and di- and tricarboxylic acid esters. The hydrocarbyl radicals of the fatty esters hereof can also include or have covalently
20 bonded thereto other compatible functionalities, such as amides and alkoxy moieties, such as ethoxy or ether linkages.

Monocarboxylic acid esters include esters of alcohols and/or
25 acids of the formula R'COOR in which R' and R independently denote alkyl or alkenyl radicals and the sum of carbon atoms in R' and R is at least 10, preferably at least 20.

Specific examples include, for example, alkyl and alkenyl
30 esters of fatty acids having aliphatic chains with from

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about 10 to about 22 carbon atoms, and alkyl and/or alkenyl fatty alcohol carboxylic acid esters having an alkyl and/or alkenyl alcohol-derived aliphatic chain with about 10 to about 22 carbon atoms, benzoate esters of fatty alcohols
5 having from about 12 to 20 carbon atoms.

The monocarboxylic acid ester need not necessarily contain at least one chain with at least 10 carbon atoms, so long as the total number of aliphatic chain carbon atoms is at least
10 10. Examples include isopropyl isostearate, hexyl laurate, isohexyl laurate, isohexyl palmitate, isopropyl palmitate, decyl oleate, isodecyl oleate, hexadecyl stearate, decyl stearate, isopropyl isostearate, dihexyldecyl adipate, lauryl lactate, myristyl lactate, cetyl lactate, oleyl
15 stearate, oleyl oleate, oleyl myristate, lauryl acetate, cetyl propionate, and oleyl adipate.

Di- and trialkyl and alkenyl esters of carboxylic acids can also be used. These include, for example, esters of C₄-C₈ dicarboxylic acids such as C₁-C₂₂ esters (preferably C₁-C₆)
20 of succinic acid, glutaric acid, adipic acid, hexanoic acid, heptanoic acid, and octanoic acid. Examples include diisopropyl adipate, diisohexyl adipate, and diisopropyl sebacate. Other specific examples include isocetyl stearyl stearate, and tristearyl citrate.

Polyhydric alcohol esters include alkylene glycol esters, for example ethylene glycol mono and di-fatty acid esters, diethylene glycol mono- and di-fatty acid esters, polyethylene glycol mono- and di-fatty acid esters,
30 propylene glycol mono- and di-fatty acid esters,

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polypropylene glycol monooleate, polypropylene glycol monostearate, ethoxylated propylene glycol monostearate, polyglycerol poly-fatty acid esters, ethoxylated glyceryl monostearate, 1,3-butylene glycol monostearate, 1,3-butylene glycol distearate, polyoxyethylene polyol fatty acid ester, sorbitan fatty acid esters, polyoxyethylene sorbitan fatty acid esters and mono-, di- and triglycerides.

Particularly preferred fatty esters are mono-, di- and triglycerides, more specifically the mono-, di-, and tri-esters of glycerol and long chain carboxylic acids such as C₁-C₂₂ carboxylic acids. A variety of these types of materials can be obtained from vegetable and animal fats and oils, such as coconut oil, castor oil, safflower oil, sunflower oil, cottonseed oil, corn oil, olive oil, cod liver oil, almond oil, avocado oil, palm oil, sesame oil, peanut oil, lanolin and soybean oil. Synthetic oils include triolein and tristearin glyceryl dilaurate.

Specific examples of preferred materials include cocoa butter, palm stearin, sunflower oil, soyabean oil and coconut oil.

The oil may be blended with other materials in the discrete droplets present in compositions according to the invention.

It is preferred that the d(0.5) volume-based median particle diameter of the hydrophobic conditioning oil droplets in the composition is less than 100 micrometres, more preferably less than 40 micrometres, even more preferably less than 10 micrometres and most preferably less than 6 micrometres.

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Larger particle diameters lead to problems in stabilising the composition from separation of components. Practical difficulties in making emulsion droplets with a median diameter of 0.02 micrometres or less are known to those skilled in the art. Thus it is preferred if the volume-based median diameter $d(0.5)$ is greater than 0.02 micrometres, more preferably greater than 0.03 micrometres, even more preferably greater than 0.1 micrometres. Preferred ranges of median diameter can be formed by combining any of the preferred minimum diameters with any of the preferred maximum diameters.

Volume-based median droplet diameter $d(0.5)$ may be measured by means of a laser light scattering technique, for example using a 2600D Particle Sizer from Malvern Instruments.

The total amount of hydrophobic conditioning oil present in the composition is preferably from 0.1% to 10 % by weight of the total composition more preferably from 0.2% to 6%, most preferably 0.5% to 4 %.

Silicone Conditioning oils

Preferred hydrophobic conditioning oils for use in compositions according to the invention are silicones.

Suitable silicones for use as conditioning oils include polydiorganosiloxanes, in particular polydimethylsiloxanes which have the CTFA designation dimethicone. Also suitable for use in compositions of the invention are polydimethyl

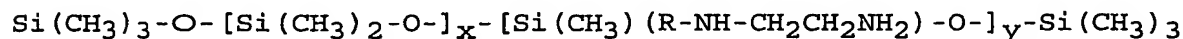
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siloxanes having hydroxyl end groups, which have the CTFA designation dimethiconol.

It is preferred if the silicone oil also comprises a functionalised silicone. Suitable functionalised silicones include, for example, amino-, carboxy-, betaine-, quaternary ammonium-, carbohydrate-, hydroxy- and alkoxy-substituted silicones. Preferably, the functionalised silicone contains multiple substitutions.

For the avoidance of doubt, as regards hydroxyl-substituted silicones, a polydimethylsiloxane merely having hydroxyl end groups (which have the CTFA designation dimethiconol) is not considered a functionalised silicone within the present invention. However, a polydimethylsiloxane having hydroxyl substitutions along the polymer chain is considered a functionalised silicone.

Preferred functionalised silicones are amino-functionalised silicones. Suitable amino functionalised silicones are described in EP 455,185 (Helene Curtis) and include trimethylsilylamodimethicone as depicted below, and are sufficiently water insoluble so as to be useful in compositions of the invention:



wherein $x + y$ is a number from about 50 to about 500, and the weight percent amine functionality is in the range of from about 0.03% to about 8% by weight of the molecule, and wherein R is an alkylene group having from 2 to 5 carbon

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atoms. Preferably, the number $x + y$ is in the range of from about 100 to about 300, and the weight percent amine functionality is in the range of from about 0.03% to 8% by weight of the molecule.

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As expressed here, the weight percent amine functionality is measured by titrating a sample of the amino-functionalised silicone against alcoholic hydrochloric acid to the bromocresol green end point. The weight percent amine is
10 calculated using a molecular weight of 45 (corresponding to $\text{CH}_3\text{-CH}_2\text{-NH}_2$).

Suitably, the weight percent amine functionality measured and calculated in this way is in the range from 0.03% to 8%,
15 preferably from 0.5% to 4%.

An example of a commercially available amino-functionalised silicone useful in the silicone component of the composition of the invention is DC-8566 available from Dow Corning (INCI
20 name: dimethyl, methyl (aminoethylaminoisobutyl) siloxane). This has a weight percent amine functionality of about 1.4%.

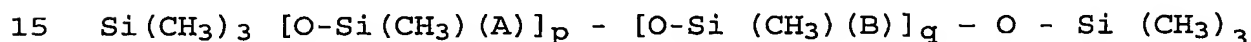
By "amino functional silicone" is meant a silicone containing at least one primary, secondary or tertiary amine
25 group, or a quaternary ammonium group. Examples of suitable amino functional silicones include: polysiloxanes having the CTFA designation "amodimethicone". Specific examples of amino functional silicones suitable for use in the invention are the aminosilicone oils DC-8220, DC-8166, DC-8466, and
30 DC-8950-114 (all ex Dow Corning), and GE 1149-75, (ex General Electric Silicones). Suitable quaternary silicone

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polymers are described in EP-A-0 530 974. A preferred quaternary silicone polymer is K3474, ex Goldschmidt.

Another preferred functional silicone for use as a component in the hydrophobic conditioning oil is an alkoxy-substituted silicone. Such molecules are known as silicone copolyols and have one or more polyethyleneoxide or polypropyleneoxide groups bonded to the silicone polymer backbone, optionally through an alkyl linking group.

A non-limiting example of a type of silicone copolyol useful in compositions of the invention has a molecular structure according to the formula depicted below:



In this formula, A is an alkylene chain with from 1 to 22 carbon atoms, preferably 4 to 18, more preferably 10 to 16.

B is a group with the structure: $-(\text{R})-(\text{EO})_r(\text{PO})_s-\text{OH}$ wherein

R is a linking group, preferably an alkylene group with 1 to 3 carbon atoms. Preferably R is $-(\text{CH}_2)_2-$. The mean values of r and s are 5 or more, preferably 10 or more, more preferably 15 or more. It is preferred if the mean values of r and s are 100 or less. In the formula, the value of p is suitably 10 or more, preferably 20 or more, more preferably 50 or more and most preferably 100 or more. The value of q is suitably from 1 to 20 wherein the ratio p/q is preferably 10 or more, more preferably 20 or more. The value of p + q is a number from 11 to 500, preferably from 50 to 300.

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Suitable silicone copolyols have an HLB of 10 or less, preferably 7 or less, more preferably 4 or less. A suitable silicone copolyol material is DC5200, known as Lauryl PEG/PPG - 18/18 methicone (INCI name), available from Dow
5 Corning.

It is preferred to use a combination of functional and non-functional silicones as the hydrophobic silicone conditioning oil. Preferably the silicones are blended into
10 common droplets prior to incorporation into compositions according to the invention.

The viscosity of the droplets hydrophobic silicone conditioning oil, measured in isolation from the rest of the
15 composition (i.e. not the viscosity of any pre-formed emulsion, but of the hydrophobic conditioning oil itself) is typically from 350 to 200,000,000 $\text{mm}^2\text{sec}^{-1}$ at 25°C.

Preferably the viscosity is at least 5,000 $\text{mm}^2\text{sec}^{-1}$ at 25 °C, more preferably at least 10,000 $\text{mm}^2\text{sec}^{-1}$. Preferably the
20 viscosity does not exceed 20,000,000 $\text{mm}^2\text{sec}^{-1}$, more preferably 10,000,000 $\text{mm}^2\text{sec}^{-1}$, most preferably 5,000,000 $\text{mm}^2\text{sec}^{-1}$.

Suitable methods for measuring the kinematic viscosity of
25 silicone oils are known to those skilled in the art, e.g. capillary viscometers. For high viscosity silicones, a constant stress rheometer can also be used to measure dynamic viscosity which is related to kinematic viscosity by the density of the silicone. The viscosity is measured at a

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low shear rate, less than 10 s^{-1} , such that the silicone exhibits Newtonian behaviour (i.e. viscosity independent of shear rate).

- 5 It is preferred if silicones are added to the compositions of the invention as pre-formed emulsions, more preferably as microemulsions.

Further Ingredients

10

Compositions according to the invention may also incorporate other cosmetically suitable ingredients, preferably at a level of 2% by weight or less. Suitable ingredients include: viscosity modifiers, preservatives, colouring
15 agents, polyols such as glycerine and polypropylene glycol, chelating agents such as EDTA, antioxidants, fragrances, antimicrobials, antidandruff agents, cationic conditioning polymers, styling ingredients, sunscreens, proteins and hydrolysed proteins. Volatile silicones such as
20 cyclomethicones may also be used in compositions of the invention.

Use

- 25 Compositions according to the invention are intended for use in the preparation of opacified hair conditioning compositions, particularly rinse-off hair conditioning compositions. It is preferred if the compositions are free of other opacifiers, in particular it is preferred if the
30 compositions have less than 0.01% by weight of ethylene

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glycol distearate, water-insoluble styrene or acrylic polymers or copolymers or metal oxides.

5 The compositions are preferably used by applying them to the hair, followed by rinsing the hair with water followed by drying. It is more preferred if the compositions are applied and massaged into hair which is already wet, following shampooing and subsequent rinsing.

10 The invention will now be further demonstrated and illustrated with reference to the following examples.

Examples

15 Compositions were prepared, as described above, using the compositions detailed in tables 1 and 2. All figures in the tables refer to the ingredients as 100% active by weight percent in the compositions.

20 Example 1 is according to the invention whereas examples A and B are comparative examples. A has no alkali metal halide and B has the same level of cationic surfactant as 1, but no dialkylethyl dimethylammonium salt. Similarly, example 2 is according to the invention, but with higher
25 levels of cationic surfactant and fatty material. Examples C and D are comparative examples to example 2. C has no alkali metal halide and D has the same level of cationic surfactant as 1, but no dialkylethyl dimethylammonium salt.

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Table 1

| Formulation | 1 | A | B |
|---------------|--------|--------|--------|
| CTAC | 2.39 | 2.39 | 2.89 |
| DEQ | 0.5 | 0.5 | - |
| KCl | 0.3 | - | 0.3 |
| Natrosol 250 | 0.2 | 0.2 | 0.2 |
| Laurex CS | 3 | 3 | 3 |
| Disodium EDTA | 0.1 | 0.1 | 0.1 |
| Glydant | 0.4 | 0.4 | 0.4 |
| Water | to 100 | to 100 | to 100 |

CTAC is cetyl trimethylammonium chloride supplied commercially as 30% active. DEQ is dipalmitoylethyl dimethylammonium chloride supplied commercially as 76% active. Laurex CS is cetyl alcohol. Glydant is DMDM hydantoin preservative. Natrosol 250 is a hydroxyethylcellulose thickener.

10 Table 2

| Formulation | 2 | C | D |
|---------------|--------|--------|--------|
| CTAC | 4.79 | 4.79 | 5.79 |
| DEQ | 1 | 1 | - |
| KCl | 0.1 | - | 0.1 |
| Natrosol 250 | 0.2 | 0.2 | 0.2 |
| Laurex CS | 6 | 6 | 6 |
| Disodium EDTA | 0.1 | 0.1 | 0.1 |
| Glydant | 0.4 | 0.4 | 0.4 |
| Water | to 100 | to 100 | to 100 |

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The samples were measured using a colorimeter (Chroma meter CR-400/410). Table 3 shows the measurement results obtained using the standard $L^*a^*b^*$ notation.

| Example | L | -a* | -b* |
|---------|----|-----|-----|
| 1 | 78 | 0.8 | 4 |
| A | 64 | 0.5 | 3 |
| B | 73 | 0.6 | 4 |

5

It is clear from the results that the example according to the invention has greater lightness and hence opacity and reflectivity than the comparative examples. This is also demonstrated by the ΔE^* values. For 1 versus A the value is 14 and for 1 versus B 5. Both of these values mean that 1 is visually perceivable as whiter and a more saturated colour than both A and B.

10